**TITLE:** **Computational Regularity: Theory and Applications**

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## ABSTRACT

Symmetry is an essential mathematical concept, as well as a ubiquitous, observable phenomenon in nature, science and art. Either by evolution or by design, symmetry implies an efficiency coding that makes it universally appealing, especially so in machine visual perception of the real world. Alas, the recognition of real world (digital) symmetry proves to be a challenging task that has been baffling computer vision and human vision researchers for decades. We explore a formal and computational characterization of real world regularity using a hierarchical model of symmetry groups. Such a formalization simultaneously facilitates

(1) a robust and comprehensive algorithmic treatment of the whole regularity spectrum, from regular (perfect symmetry), near-regular (approximate symmetry), to irregularities;
(2) an effective detection scheme for real world symmetries and their associated symmetry groups; and
(3) a set of computational bases for measuring and discriminating quantified regularities on diverse data sets (from the firing fields of grid cells to urban scenes).

I shall illustrate recent progress in the area of computational regularity, a generalized form of computational symmetry, with applications in urban scene understanding and modeling (façade extraction from Birdseye-views, streetView/aerial view matching); texture analysis, synthesis and tracking; and regularity-driven un-supervised perceptual grouping in the wild. If time permits, I shall also report our recent findings in human perception of regularities/symmetry versus deep-learning models.